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EFFECT OF *Solanum lycopersicum* ON THE CHANGES IN LIVER FUNCTION AND SOME HAEMATOLOGICAL PARAMETERS INDUCED BY METHYL MERCURY IN WISTER RATS.

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ABSTRACT
The antitoxic effect of *Solanum lycopersicum* on mercury poisoning in albino wistar rats was studied. Thirty-six wistar albino rats were randomly divided into six experimental groups (n=6). Group A (control) were given clean drinking water and rat chow. Group B-given rat chow +mercury (Hg) at concentration of 10ppm.Group C –given rat chow + 10% mass of *Solanium lycopersicum*(sl). Group D – given rat chow + sl + Hg at 10ppm. Group E-given rat chow +Hg at concentration of 10ppm for 2 weeks, then stopped and administered 10% by mass of sl. Group F –given rat chow +10% by mass of sl for 2 weeks, then stopped and administered Hg at concentration of 10ppm. The result shows a statistically significant increase (P<0.05) in liver enzymes studied-Alanine amino Transaminase(ALT) and Aspertate oxaloacetate Transaminase (AST) and a statistically significant decrease (P<0.05) in Hb, RBC, and ALT in group B. There were no statistically significant change in the parameters in Groups C,D,E,and F. This shows that mercury has a toxic effect on the liver by inducing necrosis and also a marrow depressive effect on haematopoisis. But these effect could be reduced by the administration of *Solanium lycopersicum.*

KEYWORDS: Mercury poisoning ,S*olanium lycopersicum*, Liver enzyme, methyl mercury.

INTRODUCTION

Environmental problems are on the increase worldwide, and this is directly linked to industrialization and increased petroleum exploration .The majority of known metals and metalloid are very toxic to the living organism, and even those considered essential, could be toxic if present in excess (Michalke, 2003).In the last decade, the natural environmental concentration of several chemical elements have been largely increased as a result of anthropogenic activity .These impair important physio-chemical systems constituting threat to health of plants and animals.(Michalke 2003).

Currently, the advances in toxicology has improved our knowledge of human exposure to toxic elements and their health effects such as kidney damage, endocrine disruption, development retardations, immunological disorder and even death (Moreira and Moreira 2004).

The relationship between mercury (Hg-Hydra argyrum ie silvery water) and mankind dates back to ancient times (Nriagu, 1979). It is one of the first chemical elements known to man. Mercury and its compound are highly toxic especially methyl mercury- a potent neurotoxin (Al-saleem, 1976). It is the most relevant. Other forms of occurrence in nature include metallic or elemental mercury sulfide, mercury chloride,etc.

The physico-chemical properties (eg liquid form at room temperature, uniform volume expansion, high surface tension, high vapour pressure with low water solubility, capacity of forming amalgam with several metals) have made its use diverse (eg. in thermometers, industrial process, dental surgery etc (Olivera Da Silva 2005). These processes increases human exposure to mercury in addition to improper disposal of factory wastes, contamination of food and aquatic life (Okoye 2002).

The effect of mercury toxicity in some organs and system has been well documented such as marked motor and cognitive impairment and emotional disturbances (Bakir 1973), visual disorder, ataxia, fatigue, tremor,hearing disorder (Bakir, 1973;Morret,1987) autism (Bernard, 2003),cerebral palsy, parkinsonism (Bernard, 2000, Adams, 1983).

Exposure of rat to methyl mercury in the drinking water for one month prior to mating to the end of gestation resulted in ultra structural changes in the liver of the fetus (Fowler and Wood, 1977) but there is a dearth of information on the effects on haematological process and on liver enzyme hence the need for this work.

Solanum lycopersicum commonly called "Tomato" is a plant in the solanaceae family. It is a native of central and south America. It is a short lived perineal plant grown as an annual plant (wikipedia).Tomato fruit is red and juicy fruit. The red colour is due to lycopene which is a red carotenoid pigment and a potent antioxidant (wikipedia) due to its long unsaturated chain. It also contains a high concentration of vitamin C which is made more bioavailable by cooking.

Several studies suggest that tomato consumption reduces the risk of chronic diseases such as cardiovascular disease and cancer (Weisburger 2002; Willcox 2003). Tomatoes also demonstrate increased protection from oxidative stress (Riso and Porrini 2002) in plasma, lymphocytes and lipid peroxidation.

The aim of this work is to find out the effect of bioaccumulation of mercury on the liver and haematopoitic system and possible ameliorating or antitoxic effects of *Solanum lycopersicum* on the tissue.

MATERIALS AND METHODS

Test animals

Thirty-six wister albino rats were purchased from the animal house unit of Delta State University, Abraka. The rats weighed between 150g-180g at the beginning of the experiment. The room in which the rats were kept was maintained at a light/dark cycle of 12 hrs and temperature of 28^0 C to 38 ^{0}C and a relative humidity of about 60%. The rats were allowed free access to normal rat chow (Pfitzer Nig. Ltd.) and water ad libitum

The rats were subsequently randomly divided into six experimental groups (n=6).
Group A- (control) were given clean drinking water ad libitum and rat chow

Group B-fed with rat chow and mercury in water at concentration of 10ppm

Group C-fed with rat chow mixed with 10% by mass of *Solanum lycopersicum* (sl) and drinking water ad libitum

Group D- fed with rat chow + sl + mercury in water at concentration of 10ppm

Group E-fed with rat chow +mercury in water at concentration of 10ppm (for only 2 weeks) then 10% by mass of sl for 4 weeks

Group F-fed with rat chow +10% by mass of tomatoes (only 2 weeks) + mercury in water at concentration of 10ppm for 4 weeks.

Tomatoes preparation

Tomato fruit were bought from a market in Warri, Delta State, Nigeria rinsed to remove debris. It was subsequently milled into a paste, oven dried but with little moisture to allow good mixing, weighed and subsequently mixed with the rat chow. Left over were discarded and new ones re constituted. Administration of the mercury and tomatoes were by oral route. The duration of the experiment is 6 weeks.

Collection of samples

The rats were re-weighed and the values recorded. After an overnight fast, the rats were sacrificed by decapitation. Ethical issues were sort and approval given by the local ethical committee. The blood was collected into EDTA bottle. The hematological analysis was done using automated hematology analyzer (Kx-21 by Sysmex Japan).

Liver enzyme analysis

The serum was obtained from whole blood sample centrifuged at 1,200xg for 5 mins at room temperature and used for the analysis of Alkaline phosphatase (ALP), Aspertate amino Transferase (AST) and Alanine amino

Transaminase(ALT). This was done using atomic absorption mass spectrophotometer as recommended by IFCC (International Federation of Clinical Chemistry)

Statistical analysis
Data were analyzed using analysis of variance (ANOVA) and also statistical package SPSS-PC (version 7.5) was used

RESULTS
The results obtained are as shown in the tables below.

Table 1- The changes in the weight (g) of the rats during the experiment.

	GP A (control) n=6.fed rat chow only	GP B n=6 fed rat chow +Hg @10ppm	GP C n=6 rat chow +10% sl	GP D n=6 fed rat chow +Hg@ 10ppm+10% sl	GP E n=6 fed rat chow +Hg for 2 wks then 10% sl	GP F n=6 fed rat chow+10%sl for 2 wks then Hg @ 10ppm
WK 1	161.5± 8.2	174.3 ± 1.2	164.6 ± 8.1	155.7 ± 7.1	152.6 ±1.3	164.6 ± 2.1
WK 2	172.7 ± 3.2	178.1 ± 2.2	178.2± 2.5	157.9± 2.2	166.1 ± 2.5	168.5 ± 1.1
WK 3	181.5± 6.1	166.2± 3.1	188.1 ± 4.2	150.2 ± 4.1	164.4 ± 1.8	162.2 ± 1.5
WK 4	187.2 ± 3.2	159.1± 2.2	194.8 ± 2.2	153.0 ± 1.0	161.0 ± 1.1	161.0 ± 2.0
WK 5	199.8 ± 3.4	155.3 ± 3.3	215.5 ±2.8*	155.3 ± 2.0	174.7 ± 7.8	156.1 ± 0.8
WK 6	210.7 ± 1.2	136.5±4.2*	215.9± 3.4*	169.3 ± 4.8	177.1±1.6	144.1 ± 1.6*

Data is expressed as mean ± SEM. sl =Solanum lycopersicum; Hg =Mercury; ppm = parts per million.
* Statistically significant.

Table 2 : Show hematological parameters of the different experimental groups

Parameters	GP A n=6	GP B n=6	GP C n=6	GP D n=6	GP E n=6	GP F n=6
Hb g/dl	11.27±0.09	8.23±1.13*	11.87±0.43	10.78±0.84	8.72±1.53*	10.08±1.91
RBC ($X10^6$ mm^3	5.43 ± 0.89	3.52 ±1.52*	6.01 ± 0.82	4.79 ± 0.34	3.91±1.74	4.09± 1.10
WBC ($x10^3$ mm^3	7.81 ± 0.04	8.92 ±2.27	7.85 ± 0.63	6.55± 0.68	7.88±1.74	5.98 ± 0.83*
Hct %	35.81±0.08	23.9± 8.10*	37.61±2.30	32.14±9.40	26.86±6.92*	31.70±4.20
PLT(10^3 mm^3	210.28±37.86	446.17±0.68	192.67±19.70*	336.50±1.72	421.83±19.72	330.45±1.21
Lym %	83.55± 0.04	76.23 ± 8.02	83.98± 6.02	84.35 ± 4.95	89.12± 4.92	86.27 ±6.55

Data are expressed as mean ± SEM, Hb =Haemoglobin concentratin, RBC =Red blood cell, WBC =White cell count, H ct =haematocrit,PLT =Platelet count, Lym = lymphocyte count.
* statistically significant

Table 3: Liver enzyme analysis at the end of the experiment.

Parameters	GP A n=6	GP B n=6	GP C n=6	GP D n=6	GP E n=6	GP F n=6
ALT(µ /l)	2.11±0.09	4.05±0.05*	2.21±0.50	2.25± 0.04	2.75± 1.42	2.54± 0.65
AST(µ /L)	1.85±0.04	4.47±0.14*	1.94± 0.29	2.72± 0.60	4.20±2.86*	3.31± 2.30
ALP(µ /l)	4.45±0.14	4.62 ±0.20	4.55± 0.90	4.40±0.20	4.55±0.85	4.22±2.19

Data expressed as mean ± SEM. ALT =Alanine amino Transaminase. AST = Aspertate amino Transaminase. ALP =Alkaline phosphatase.
* Statistically significant.

DISCUSSION

The result obtained is as shown in the table above.
Table 1- shows a significant decrease ($p<0.05$) in the total body weight of the rats in group B which shows that the administration of mercury alone has a deleterious effect on the total body weight of the rats. This is consistent with the earlier report that children born of mercury poisoned mothers were of small total body weight and decreased brain weight at birth (Takeuchi, 1968; Amin-zaki, 1974).

The data also shows that the group fed *Solanum lycopersicum* only showed a statistically significant increase ($p<0.05$) in body weight at the 5^{th} and 6^{th} weeks of the experiment.

The data in the other groups did not show any statistical difference in the total weight which means that *Solanum lycopersicum* has an ameliorating effects on the toxicity of mercury.

The data on Table 2 shows a statistically significant decrease ($p<0.05$) in the haemoglobin concentration in group B and an increase in total white blood cell count which was not statistically significant.This is consistent with the previous report of anemia caused by mercury toxicity (UNEP 2002).

Solanium lycopersicum caused an increase in haematological parameters analysed but it was not statistically significant. This shows that mercury has a marrow depression effect on the rat, with this effect significantly reduced by co-administration of *Solanium lycopersicum.*

Table 3 shows a statistically significant increase ($p<0.05$) in the liver enzymes –Alanine Amino Transaminase (ALT) and Aspatate Amino Transaminase(AST) but showed no effect in the Alkaline phosphatase level. This may likely be as a result of liver necrotic effect. This finding is important as there is a dearth of publication in this area of mercury toxicity. Therefore further work for liver histology to ascertain the level of necrosis is recommended.

CONCLUSION

This work has shown that *Solanum lycopersicum* has a modifying effect on the multi-organ deliterous effect of mercury toxicity. Therefore an increased intake of *Solanum lycopersicum* is encouraged because of its antitoxic effect.

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REFERENCES

Adam,CR., Ziegler, DK., and Lin, JT., (1983);Mercury intoxication stimulating Amyotrophic lateral sclerosis. *JAMA* 250:642-643.

Al-Saleem, T.,(1976); Clinical committee on mercury poisoning. Bull.World Health Organ 53(suppl) 99-104.

Amin-Zaki,L., Elhassani,S., Majeed,MA., Clarkson,TW., Doterty,RA., and Greenwood, M.,(1974) ;Intra-uterine methyl mercury poisioning, *Paediatrics* 54:587-595.

Bakir,F.,Kamluji,SF.,Amin-zaki,K., *et a*l.,(1973); Methyl mercury poisoning in Iraq. *Sciences* 181:230-241.

Bernard, S.,Enayatt, A., Redwood, L., and Bistock,T.,(2000); Autism:A novel form of Mercury poisoning .The Autism research institute.

Fowler, B., and Woods,JS.,(1977); Transplacental toxicity of methyl mercury to fetal rat liver mitochondria. *Lab Interest*,36;122-130.

Michalke,B.,(2003); Element speciation definition analytical methodology and some examples. *Ecotoxicol. Environ.Saf* .56:122-139.

Moreira,FR.,Moreira,JC.,(2004); Effect of mercury exposure on the human body and health implications. *Rev.Panam.Salud..publica*.15:119-129.

Mottet,NK.,Metsanithy, L.,(1987); Selenium-Mercury interaction during intestinal absorption of 75 Se compounds in chicks. *J Nutr*. 117:1453-1458.

Nriagu, JO.,(1979); Production and uses of Mercury. The Biogeochemitry of mercury in the environment: topics in Environmental health. Amsterdam, Elsevier/North Holland. Biomedical Press.

Okoye,PAC.,Enemuoh,RE., and Ogunjiofor,JC., (2002); Traces of Heavy metals in marine crabs. *J. Chem. Soc. Nig*. 7 (1):76-77.

Oliveira da Silva, AL. ,Barrocas PRG., Docouto Jacob S. ,Moreira,JC. (2005); Dietary intake and health effect of selected toxic elements. *Braz.J. Plant Physiol*.17(1) 1-25.

Riso,P., and Porrini, M., (2001);Tomatoes and health promotion in vegetables, fruit and herbs in Health promotion (ed) RR Watson, Boca Raton;CRC Press:Pp 45-70.

Takeuchi,T., (1968); In: Minamata disease,(ed):M.kutsama Kumamoto Univ Press. Japan Pp 141-228.
UNEP(2002); Global Mercury assessment, United Nations: Effects of inorganic Mercury on in vitro placental nutrients transfer and oxygen consumption. *Reprod.Toxicol*. 6:69-75.

Weisburger, JH., (2002); Lycopene and Tomato product in health promotion. *Exp Biol Med*. 227: 924-927.

Willcox,JK., Catignani,GL., and Lazarus, S., (2003); Tomatoes and cardiovascular health. *Crit Rev. Food Sci. Nutr*.43:1-18.

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